

STUDIES  
IN THE  
HISTORY AND METHOD  
OF SCIENCE

EDITED BY

CHARLES SINGER

VOL. II

163186.  
25.6.21.

OXFORD  
AT THE CLARENDON PRESS  
1921

# CONTENTS

	PAGE
I. CHARLES SINGER	
GREEK BIOLOGY AND ITS RELATION TO THE RISE OF MODERN BIOLOGY . . . . .	1
II. J. L. E. DREYER	
MEDIAEVAL ASTRONOMY . . . . .	102
III. ROBERT STEELE	
ROGER BACON AND THE STATE OF SCIENCE IN THE THIRTEENTH CENTURY . . . . .	121
IV. H. HOPSTOCK	
LEONARDO AS ANATOMIST. Translated from the Norwegian by E. A. Fleming . . . . .	151
V. E. T. WITHINGTON	
THE ASCLEPIADAE AND THE PRIESTS OF ASCLEPIUS	192
VI. J. J. FAHIE	
THE SCIENTIFIC WORKS OF GALILEO (1564-1642). With some account of his life and trial . . . . .	206
VII. F. J. COLE	
THE HISTORY OF ANATOMICAL INJECTIONS . . . . .	285
VIII. F. S. MARVIN	
SCIENCE AND THE UNITY OF MANKIND . . . . .	344
IX. F. C. CONYBEARE	
FOUR ARMENIAN TRACTS ON THE STRUCTURE OF THE HUMAN BODY . . . . .	359

FOUR ARMENIAN TRACTS ON THE STRUCTURE  
OF THE HUMAN BODY

BY F. C. CONYBEARE

	PAGE
I. Introduction . . . . .	359
II. Contents of British Museum MS. Or. 6798, fo. 2-11 . . . . .	364
III. Translation of the Four Tracts . . . . .	367

I. INTRODUCTION ,

ARMENIAN medicine was a closed subject until the appearance of Ernest Seidel's *Mechitar's Trost bei Fiebern* in 1908. That work, together with the texts here rendered, will enable the occidental reader to form some idea of the character and sources of mediaeval Armenian scientific ideas.

The British Museum Codex, Or. 6798 (Catalogue, no. 138),<sup>1</sup> is the source of our four treatises on the formation and Structure of the Human Body. It is a composite MS. formed of several distinct books and written by at least four different hands. The first section of this MS. contains our four treatises. This section consists of some 50 vellum leaves in double columns of 35 lines each. The writing is of the late cursive type called *notergir*, or notary's, small, but neat and clear. The titles of the sections or chapters are given in red. Folios 56-127 contain a second and separate book, written on paper in double columns of 32 lines, in a hand closely resembling the first. This second book gives our first two treatises over again in an identical text, with the same truncated colophon (see § 21 below). Either it was copied from the vellum book, or both were copied from a common source. As in the first book, so in this, the last tract is attributed to Gregory of Nyssa (§ 23 in our translation).

In addition to the two copies of our texts in the British Museum

<sup>1</sup> I would like here to correct an error in my catalogue of the Armenian MSS. of the British Museum. Misled by the numeral 3 affixed in the margin to the so-called treatise of Gregory of Nyssa on the folio of MS. 6798, I suggested that it was misplaced and should precede f. 4, in such a way that this treatise followed the Introduction and intervened between §§ 2 and 3. The folio was really in its right place, and the secondary text at f. 109b equally begins Gregory of Nyssa's tract after § 20 which describes the Seven Members, although § 21, on the Parts of the Body, is omitted.

volume, nine others are known to exist in a more or less complete state; of these, seven are in the Mechitarist Library at Vienna, one is at Munich, and one in the Bibliothèque nationale at Paris.<sup>1</sup> The four texts vary a good deal, but our version is practically identical with one of the Viennese (294). The great variety of readings indicates that the works had long been current and popular at the time when the variant MSS. were written.

The circumstance that the excerpt of Mechitar Heratzi (see § 1) occurs in at least two other MSS., and is followed by a passage which may be attributed to Asar (see next paragraph), suggests that the latter may himself have made the addition. As a physician Asar may well have had access to other works of Mechitar (who was a Cilician physician, c. 1150–1200) besides that on Fevers: that work the Mechitarists of Venice printed in Armenian in 1832,

<sup>1</sup> The Vienna MSS. 678 and 294 exactly agree with ours in texts and in the ordering of the contents. No. 658 of the same collection resembles it.

Another Vienna MS. no. 17 in Dashean's Catalogue, less allied in text to ours than no. 294, is a recent copy of an older MS. of unknown age; it gives the same contents in the same order.

The Vienna collection contains five other similar MSS. No. 436 is a late cursive. It begins with § 1 and ends with § 18, but Dashean's Catalogue gives no further information. No. 442 also contains it, and begins with § 1, but ends with § 17. The third MS., no. 466, begins with § 2, but what else it contains Father Dashean does not say. No. 254 is of the 17–18th century. The tract begins f. 7<sup>ro</sup>, and contains §§ 1, 3, &c., but the codex is very defective through loss of leaves, and Dashean does not record its contents very fully. A fifth text is given in codex 540 of the same library, written in 1669. This contains the works of Galust, a physician of Amasia of that age. This text begins with § 1 and ends with § 20.

A Munich codex, no. 2, written in 1602, contains our text, beginning f. 71<sup>ro</sup>, but I have only the barest details of its arrangement and contents, though Hunanean in his two volumes on ancient vulgar idioms of Armenia (Vienna, 1897), gives excerpts of—

A Paris MS., no. 108, ff. 29–45, contains the same text. Hunanean writes that he had examined ten MSS. of this work, and notes that two of them only, Vienna 294 and Paris 108, insert the excerpt from Mechitar Heratzi which I number §§ 3, 4. It ends with the words: 'So ends the description of the visual faculty by the will of God.' Our MS. continues without a break the rest of the discourse about the eye. Our MS. is thus a member of a close group consisting of three texts. Very slight differences divide them in respect of this excerpt; e. g. Vienna 294 and our MS. employ the word *Quawashs*, whereas Paris 108 substitutes *Vuslays*, and 294 and our MS. use the Middle Armenian plural *astarni*, whereas Paris 108 has the classical form *astarg*.

Hunanean cites § 1 according to the four codices, Vienna 294, Vienna 540 (Galust's codex), Munich 2 (written probably in 1602), and Vienna 17.

and a scholarly German version of it, with valuable commentary, was published in 1908 by Ernest Seidel. This treatise is much quoted in Asar's *Manual of Therapeutics* in the Mechitarist Library of Vienna (MS. 287), and is given twice over in a British Museum MS. (Codex f. 129 b and 41 a). It consists of 123 chapters, and cites many of the ancient Arabic and Armenian medical writers that are cited independently in the Great Tripartite manual of Medicine or Akhrapatin (i.e. *Γραφίδιον*) of Amirtovlath of Amasia, of which a magnificent vellum codex exists in the British Museum (Cat. Armen. MSS. 134, Or. 3712). Amirtovlath wrote c. 1466.

It is thus not impossible that § 1 of our tract is from the pen of this Asar, for in the preface to that writer's *Manual of Therapeutics* the comparison of the physician's art to that of the religious confessor (§ 1, paragraph 5) recurs in the same words. However, it is a commonplace often met with in Armenian medical treatises, so we must not attach too much importance to this. That one was copied from the other, or both from a common source, is, however, certain, since the language is the same. I translate herewith Asar's preface as it is found in our MS. (Brit. Mus., Or. 6798) and the Vienna MS. 287 :

‘ In the name of God the merciful and compassionate. A book of the healing art, as prescribed by wise philosophers and healing doctors for the understanding of man's nature and for ministration to the sick unto the uses of healing.

‘ For as by means of confession and true repentance they receive healing of soul, so likewise at the hands of healing doctors and with the aid of drugs they shall receive bodily health and be quit of their maladies. So now the humble in spirit, I, the servant of God's servants, the unlearned and much sinning Asar of Sebaste, have desired to collect the selection, and in brief to set forth according to our wants, a little out of much of the words of the philosophers, and to minister to sufferers, unto the uses of healing. And may the Creator vouchsafe health unto all according to his good and benevolent will, and to him be glory,’ &c.

We may now devote a few lines to the discussion of the identity of the physician Abu Sayid, who is quoted in the first of our tractates (§ 1, paragraph 2). Two physicians of that name meet us in the history of Armenian medicine. The earlier was a contemporary of Gregory son of Vahram early in the eleventh century, and Amirtovlath cites his remedies more than once, e.g. in the following, which is given in Hunanean (ii. 415) :

‘ For liver disease due to fever we also copy out the remedy

used by Grigor son of Vahram much to his advantage at a time when he suffered in his liver through fever, and went to Mufarain (i. e. Nfkert) in the year 1037. And it was a prescription of Busayid and did him good. And his symptoms were these: pain in the back and right arm and heaviness of the hand, and internal stabbing pain in the back where the ribs fall away. When he lay down on his right side he felt acute pain and grew feverish, and wine and anything he ate hot gave him constipation (*or* ? aggravated it). So when this malady came on he went to Mufarain; as it was in winter time, the doctor gave him no medicine, saying: At this time of the year drugs will do you no good, for the man is frozen like the earth, and drugs are useless. But he gave him cool drinks, such as pomegranate liquor, &c., and let him eat what he liked. Then when spring came he prescribed him this treatment for forty days,' &c.

The Armenian prince evidently suffered from neuritis. Here is another mention of Abu Sayid from the same source:

‘Another remedy which we have copied from Abu Sayid’s manual of medicine, which Gregory son of Vahram used when his liver pained him and he went to Mufarain, as he did every spring, and derived great profit therefrom for several reasons: Take damask plums and twelve jujubes,’ &c.

This Abu Sayid of 1037 was probably a Syrian or an Arab, but some of his writings were clearly preserved among the Armenians as late as the second half of the fifteenth century, either in the original or in Armenian translations.

Rather more than one hundred years later we have a notice of another Abu Sayid, a physician and savant, who was a friend and correspondent in turn of Nerses Shnorhali the Graceful, patriarch of Sis in Cilicia, who died A. D. 1173, and of Nerses of Lambron, bishop of Tarsus, who died 1198. Shnorhali, in his commentary on St. Matthew, states that he consulted this Abu Sayid about the reconciliation of the rival pedigrees of Jesus in the first and third gospels. He calls him a physician and savant, and wanted to know what solution was provided of the difficulty in Abu Sayid’s Church. This proves that Abu Sayid was not an Armenian but a Syrian Christian. It was also at his request that Nerses of Lambron composed his tract on the *Names of City Builders*, published in the *Ztschr. f. Arm. Philologie*, 1903, I, p. 206. As Nerses wrote in Armenian, we infer that his friend Abu Sayid could at least read that tongue. He probably wrote in Syriac or Arabic.

It is impossible to say for certain to which of these personages the reference in § 1, the Prologue, refers. The circumstance that the tract is in the Middle Armenian idiom of Cilicia proves nothing, for if it was originally written in Syriac or Arabic, an Armenian might translate it as well later as sooner. There is, however, some evidence for Nerses of Lambron being the translator, in which case it is likely to be the work of the Abu Sayid who was his contemporary. This evidence consists of three notices to the effect that this Nerses composed such a treatise. The first is found in a short but anonymous life of him cited by Alishan, the modern historian of Armenia, in his volume of *Sisuan*, p. 91. The second is in a colophon printed, apparently from the MS., of Nerses's meditation and prayers in connexion with the *Dormitio Iohannis*. The third is a notice, printed in an edition of sundry works of Nerses printed at Cpl. in 1736, to the effect that he wrote the book on the *Formation of Man*. On the strength of these notices Hunanean inclines to believe that Nerses of Lambron was the translator. He was certainly familiar with Syriac, for we have Armenian versions of Syriac originals from his pen. Hunanean confesses himself unable definitely to fix the date of the tract from the language in which it is composed, but finds no difficulty, as we have seen, in attributing it to Nerses of Lambron, who died in 1198. I find myself a great affinity between its idiom and that of Mechitar Heratzi, the author of the work on Fevers. It would be out of place here to go into details, and I will mention only two striking facts. Both in it and in Mechitar we find *ukhtavoruthiun* for *akhtavoruthiun*, a sign, though one rarely encountered, of the phonetic decay of the vowel *a* in that age. Again, instead of writing *erkouorek* for 'testicles', both writers employ the form *ekavorek*. This is a rare form, so rare that Dr. Seidel, excellent scholar as he is, has not understood it. I confess that I can in general see no distinction between the Armenian style and idiom of Mechitar and that of the author, whoever he was, of our tract. It is possible that Mechitar, who was a friend of Nerses Shnorhali, and wrote his work on Fevers in the year 1184 (when Nerses was Patriarch of Sis), may himself have executed the translation of Abu Sayid at the wish of Nerses. It was a common thing for learned men to undertake such tasks at the behest of a prelate; and that may be the reason of Nerses of Lambron's name being attached to it.

As regards our fourth treatise, it is needless to say that Gregory of Nyssa, whose name is attached to it, had nothing to do with the work, and that the tract of which I have here (§ 23) translated the first few pages is falsely attributed to him. It awaits more complete treatment than I have been able to give it. It was the connexion in literary tradition of this Father of the Church with Nemesios which gave rise to such an extravagance. The work of the latter exists in Armenian, but has nothing in common with the work ascribed here to Gregory of Nyssa.

We have, then, in these four treatises a monument of the medical learning of the Armenians not later than the twelfth century. It would need a wider acquaintance with the many MSS. of these works than I have had the opportunity of making, to decide whether and how far the texts have been amplified by medical editors and scribes like Asar of Sebaste. We must not, for example, without further inquiry, attribute to the original form of the treatise the ascription to some planet or other of each organ of the body. These ascriptions in our work invariably come at the end of the section devoted to the particular organ, and may easily therefore be a later accretion from the pen of Asar, who in the colophon of § 21 admits that he in some way completed Abu Sayid's work, and who no doubt incorporated in it §§ 3, 4.

Like the later medical schools of Europe, the Armenian was dominated by Arabic learning. Most of the technical terms used are Arabic, much disguised in their Armenian dress. Equally so are the names of Greek medical writers that often came first through Syriac, and from Syriac through Arabic. Bagarat, for example, a common and distinguished name in Armenia and Georgia, disguises Hippocrates. In other Armenian medical treatises we have Archigenes disguised as Ardjidjanes or Ardjiasus, Paul (of Egina) as Flaus, Oribasius as Arpisaus, Rufus as Upufaus, Diogenes as Deudjanis, and so on.

## II. CONTENTS OF BRITISH MUSEUM TEXT

[Press-mark Or. 6798 ; Cat., no. 138, fo. 2-11]

The text that we here print contains four separate works, of somewhat different style and motive :

- I. § 1-§ 18 is a complete and systematic treatise on the structure and functions of the organs of the body. It is perhaps the work of the physician Abu Sayid, who lived in the



twelfth century, but his work has been amplified by one or more medical scribes such as Asar.

The British Museum MS. has a colophon at the end of § 18 attesting that 'This Book was written by Halathzaden', and we are asked to remember Astuadsatur the Elder, 'our father'.

Whether 'this book' refers only to the treatise which precedes is not clear. It is, however, an indication that §§ 19 and 20 formed once a work separate from the treatise.

II. § 19–§ 21 is a separate and more theoretic work, which deals chiefly with the numbers of the various organs and with their relation to the mental and spiritual qualities and with the causes of disease. The colophon expressly states that it is imperfect.

In the British Museum Codex Or. 6798 this colophon, § 21, is truncated. But in the Codices of the Mechitarists' Library at Vienna, 678 and 294, which otherwise presents a text identical with ours and which was copied from 678 in A. D. 1625, it runs thus :

*'Now, Brethren, our original was very imperfect and faulty, but, by the help of God, Asar of Sebaste (Sivas), the scribe and true disciple of the book, having with excessive erudition given his leisure to foreign works, with much labour was barely able to bring it to so much accuracy as this. But you that are aided by it, bear in mind the sinful much toiling Asar the Scribe and myself, the sinful penman who has soiled the pages of the paper and am also called the penman. Mark, O beloved among sages, to accept from me the word of the Apostle Paul, that there is won of your goodwill the grace of the Lord' . . .*

It is highly improbable that the author of this longer notice would have gone out of his way to incorporate in it the phrases italicized from the shorter notice. The MS. which thus enables us to restore the colophon was written in 1625 at Ispahan by one Paul the Monk.

III. § 22 is a short note on the relationship of the various organs to each other. It was, as its colophon tells us, transcribed by, if not the work of, one Halathidy.

IV. § 23 is a spurious work attributed to Gregory of Nyssa (c. 331–c. 396) on the formation of the foetus in the mother's womb. Only the first part is here rendered by way of giving an idea of its contents and character and of identifying it.

The tractates here translated consist of the following sections, the numbers affixed being my own and not those of the MSS. :

- I. 1. Introduction.
2. Concerning the Head and Brain.
3. Concerning the Eyes.
4. Concerning the Muscles of the Eye.
5. Concerning Vision (in the text no title is given).
6. On the Ear.
7. On the Nose.
8. On the Mouth.
9. On the Heart.
10. On the Lungs.
11. On the Liver.
12. On the Spleen.
13. On the Kidneys.
14. On the Gall.
15. On the Bladder.
16. On the Testicles.
17. On the Stomach.
18. On the Guts.
- II. 19. On Sinews (*or* Nerves), Ducts (*or* Veins), and Blood in General. Begins : 'The all wise God formed the joints of man . . .'
20. On the Seven Members (*or* Organs) whereby man hath Life. The first is the Brain.
21. Colophon.
- III. 22. The Parts of the Body.
- IV. 23. A work attributed to Gregory of Nyssa, beginning : 'Man is said to be of four constituents.'

I have to thank Dr. Singer for supplying me with photographs of the British Museum MS. as well as for many suggestions ; and my gratitude is especially due to Father P. N. Akinian of the Mechitarist Convent of Vienna for the care with which he has revised my translation, correcting it in numerous passages and furnishing the right meanings of many obscure terms.

## III. TRANSLATION OF THE FOUR TRACTS

## TRACT I

1. *Concerning the formation of man and the creation of all the members (or organs) of man, by the will of God.*

Of truly able select philosophers and healing doctors, Hellenes and Greeks, for the understanding of the nature of man's body, mouldings and members, bones and articulations, ducts (*or veins*) and sinews. How they were created and what are their respective natures or functions, whereby they supply with moisture all the members<sup>1</sup> of the body.

But also the exciting causes (*lit. movements*) of diseases and the remedial aiding of the same, and the operation, as understood by the great physicians Galen, Aristotle, and Bagarat (Hippocrates), by whom [the remedies] were disseminated among Greeks and Assyrians and Persians and Indians, among Hellenes and Arabs, and were disseminated unto all the corners of the world by the Giver of grace from above, and there were able men of all races. And at their behest and by their words many investigated and made themselves wise and able. Among whom was also one called Abu Sayid, who took from the books of the chief physicians sincerely and concisely, and bestowed on us this treatise, correct and succinct, unto the praise and glory of God, who fashioned creation and equipped all with utilities as he willed and made all, and what he commands comes to be.

And who is able to search out the deep things of God? for whatsoever God made is exceeding good.

God made water, earth, sea, and dry land, beings of fire and beings of clay, beings spiritual and those that breathe, animals and birds, plants and vegetables, and all else. God made the body of Adam, and vouchsafed to him rational spirit and charged him to love God and keep his commandments. And the love and science of man, to discover this was the art of healing, by means of healing doctrine and co-operation of drugs to minister to the suffering unto the uses of health.

For by means of the confession of sins and acceptance of repentance a man shall receive healing of soul, and at the hands of physicians and with the aid of drugs he shall receive bodily health by the will of God, as saith the prophet: He that hath not bodily health, cannot serve God in spirit.

The wise<sup>2</sup> Galen says that God created man like a city, having twelve gates by which drugs and foodstuffs enter, while superfluities go out, whereby the system (*or person*) is constantly aided.

And of these twelve gates, of which we spake, two are eyes, two ears, two nostrils, one the mouth, two the breasts, one the navel, and two exits, one for discharging water and the other the posterior.

But there are two great channels on the two sides of the haunches (*buttocks, lumbus, ilium, or coxa*). And on each side of the haunch 180 channels open, which makes 360 ducts in movement, from all of which the members derive material and are strengthened.

Also as there are four winds which blow over the world, from East, West, South, and North, and as the year is divided into four seasons, Spring,

<sup>1</sup> *Member* is used both of internal organs, heart, liver, &c., and of external limbs.

<sup>2</sup> Perhaps the treatise of Abu Sayid begins here rather than with § 2. In any case § 1 up to this point must be a composition of Asar's, the editor or redactor of Abu Sayid's work as we have it here.

Summer, Autumn, and Winter, so the life of man is divided into four portions. For in childhood and the first age, man's nature is hot and moist, because it is dominated by blood and eastern air and follows the spring season, for the nature of spring is hot and moist. But in the second age, while youth lasts, nature is hot and dry, being dominated by bile and southern air, and follows the summer season, for the nature of summer is hot and dry.

And the third portion of life is in nature cool and dry, being dominated by bile (*savta*, *χυλός*) and western air, and it follows the autumn season, for the nature of autumn is cool and dry. And when man enters the fourth portion, it is old age, and his nature is cold and moist, for it is dominated by phlegm (*palām*, *πύματα*) and north wind, and follows the winter season, for its nature too is cold and moist.

The wise say that when God created Adam it was springtime, and night and day each consisted of twelve hours, and the sun was in Aries in the first degree. Therefore when spring comes, everything turns green and sprouts up out of the ground; and all animated beings are stirred, and humours (lit. minglings) of body are subtilized, and blood and bile ferment and are rarefied. Wherefore all physicians have bidden in spring days to bleed and imbibe purgatives, for all men's humours in this manner are made to ferment and in these days grow soft and rarefied. But there are formed in the person of man four kinds of liquid, salt and bitter, sweet and ill-smelling. Salt liquid is of the eyes, for were it not salt it would melt the fat of the eyes. And bitter liquid is of the ears, for were it not bitter, flies and creeping things would enter the ears, and a maggot would be there and do harm. And sweet liquid is of the mouth, which receives the savour of things eaten. And ill-smelling liquid is in the loins, whence comes seed, and offspring is generated therefrom.

So far so good.

## 2. Concerning the structure of the Head and the Brain.

The wise Galen says that God made the human head and set within it the brain, and of all wisdom and faculty of movement did he set the seat therein. God made the human head in three portions. The first he made the place of sensation and of light's filaments of the eyes. The second portion he made a vessel of the consciousness and of the intelligence (*antidjeli*, *djeldsch*). And the third portion he made the place of guarding, that whatever it sees and understands, therein it may guard and study it.

And God devised the head of seven layers (*tapala*) and seven membranes, in every layer one membrane. For all these are a protection of the brain that there may reach it suddenly no whit of mischief (? *zenuthiun*) nor any pain. The first layer is the hair; the second the skin; the third the flesh; the fourth the bone; the fifth is another skin enclosed within the bone; the sixth is a skin over the brain and interiorly another; the seventh is the brain. And God instituted all this protection of the brain that chill or heat should not be able to penetrate to it, and do harm (? *zên*) to it; for the brain is master of the house and in command of the heart. And the heart is sovereign of the whole person, and than the heart or brain there is no more excellent (*alêk*) member in the body. For health and life reside within the heart, but intelligence (*or* consciousness) and initiative in the brain.

And the hair of man was made by God and devised out of consumed (*or* burned) blood, and in proportion as the consumed blood increases, the hair takes increase (? *lalapa*) and waxes strong and long; and more and more this arises from the blood which is consumed, for while the man is alive and healthy it is made from pure blood. But when fleshiness (? *mis*) increases

and phlegm (= *pituita*) in him, the hair does not sprout, and the man whose hair grows thin, his nature becomes phlegmatic; but if a man's head is grown bald, that is due to red bile. But man hath grace and shame in the brain, and when a blow (*or* pain) affects the brain, it causes a lack of two things in the man, and the man becomes unconscious (lit. silly) and insensible, so that he cannot know and understand what is good and what bad. And if the blow falls on the middle of the brain, which is the seat of domination and consciousness, or if it be excessive and concentrated, the mind fails and he swoons and can comprehend nothing.

But if the injury befalls the posterior cavity which is the retentive (? *ἐκτικός*), forgetfulness comes over him, so that he knows no more, either past or future. Medical men have said that they knew cases where men were so injured, with the result that they forgot the names of their own fathers and mothers who begat and bore them. And there were some who, when they were yawning, even forgot to shut their mouths, so oblivious did they become. And this affection visits men in grey-haired age more severely than at any other time, and interiorly is due to phlegm (*pituita*).

And there is, furthermore, a path leading from the brain to the heart, so that the brain incessantly has the heart in view; and when this path is open, a man is subject to the disease called swooning (*saqthay* = syncope); and it often happens that when this affection prevails, a man is bereft of consciousness and intelligence, and the colour of his face goes. And not a few physicians through ignorance of this affection imagine the patient to be dead and hand him over for burial, for one who is suffering from it is as it were dead and the colour leaves his face. For when the passage to the brain from the heart is blocked, the heart is unable to absorb water any more from the brain, and the life of the heart and its warmth are unable to reach the brain, with the result that the latter is congealed; and then this affection occurs and manifests itself in the man. For if life and illumination and substance were not in (*or* from) the heart, the brain would quickly be congealed and the man die.

But if there were not coolness and moisture in the brain to counteract the heart's heat, this heat would rapidly consume the entire person. And God made the brain cool and damp, and set the moon over it as its controller<sup>1</sup> (*or* arbiter), but made the heart hot and dry, and set the sun over it as its controller. And these two by their nature give strength and support to one another, and substantiate each other, and they fare well with God's help.

### 3. Concerning the structure and formation of the Eyes.

The great Meehithar has said that every physician who wishes to tend the eyes must study the structure of the eyes, treatment of which is [given] by philosophy; and in these recipes (*vuslays*)<sup>2</sup> the eye was not described, not even in the *alrapatin* (*γραφίδια*, *pharmakopoiia* or *therapeutica*). So then, I, Meehithar, was minded to describe the formation of the eye in brief, and relate how many tunics (*tapala*) there are which are linings (*astayni*) of the eyes, or how many *rutupat* which are humours of the eyes, or how many tendons *azaltunae* (Arab. *zala*) which are muscles of the eyes. And I describe the visual (*or* contemplative) spirit, where it belongs and how it proceeds and progresses along conjoined (*or* equal) fibres which they name the *Lusénion* (i. e. retina): it is necessary to know this, because ancient

<sup>1</sup> *tanuter*, an astronomical term, lit. house-lord.

<sup>2</sup> *Nuslay* or *Nuskhay* in Paris MS. 108. Our MS. and Vienna 294 read *Qunnash*; ? an Arabic word.

philosophers have somewhat contradicted each other concerning the membranes of the eyes ; for some say there are six ; others five, others four, others three, and some two tunics. But I hold with Galen, for Galen and his following said there are seven [of] the eyes, and three humours and nine muscles, and I mention all, one by one, by the aid of God.

We now describe the tunics of the eyes.

Now the first tunic that is interior attached to the bone, which the Tadjiks (Arabs) call the *zulpie*, which is to be translated the hard body (i. e. sclerotic) ; it is more sinewy and firm and hard than the other membranes, which is why they so named it, and it attaches to the bone which separates the bony ruggedness (?) from the eyes, and protects the eyes and prevents mischief (*zahokn*, accus. of *ahok*) from getting into the eyes. For the first meninx (*mizl*) is interior, and of the cranium there are two meninges, the one (attached to) the bone and the other attached to the brain. Now the one attached to the bone, hard is its body and sinewy, and it possesses many veins (or ducts) from the artery, and its use is to keep off the bone's ruggedness and weight from the brain, and prevent injury (*tchahok* ?) to the brain.

And the second meninx which attaches to the brain is more delicate and soft and pure than the first, so that it may not weigh on the brain, and its body likewise is subtle <sup>1</sup> of veins, and of the artery. And this membrane which is named sclerotic, is engendered of (or ? engenders) this meninx which attaches to the cranium.

And the second tunic is that which is named *shmima*, i. e. placenta ; this they call *sekin* (choroide), and they call *shmima* the skin which covers a child in its mother's womb, and it is born with this membrane ; by this metaphor they have illustrated it, and have called it by this name (viz. *mater*). And it belongs to this meninx which lies upon the brain, as we mentioned before.

The third tunic which they have named *lapagia*, which is to be translated *ark* (i. e. retina), for it has the semblance of an ark, wherefore it was so called, and the thing owes its origin to the placental (? *shmima*) membrane.

But after this come three humours. There is a humour which they have named glass (*zudjadji*), which is to be translated *apikeni* <sup>2</sup> (i. e. vitreous), because it has the semblance of white glaze. Wherefore they have so named it.

Now this is followed by a humour which they have named *djaliti*, which is to be translated *sarneni* (or crystalline), pure and resplendent and circular, and you must know that the crystalline is a conspicuous (lit. glorious) and precious appurtenance of the eyes. . . . For through it arises the visual (faculty) and perception of colours and forms, and its roundness is to the end that it may not incur mischief (*tchahok*) and adverse shocks, impinging on it. For the reason that the arteries in those places remain at peace from the roundness, and the crystalline (ternic) is in the middle of the eyes like a ball, held in the midst, or like a (central) point in a circle, and it is surrounded and protected by all the membranes, and humours subserve the precious (thing), in order to ward off mischief (*tchahok*) and secure its welfare continually.

And after this is the fourth tunic which they name *yanqaputhia*, which is translated *sardosteni* (arachnoid), because it resembles a spider's web, and is subtle and limpid and pure, wherefore it is so called. And it lies between the crystalline and the white of egg in the middle, that mischief (*tchahok*) may not from its humours happen to the crystalline.

<sup>1</sup> Perhaps the sense is ' delicately veined and supplied with arteries '.

<sup>2</sup> In Paris 108 *apakini*.

And besides this there is an humour which they name subtil white of egg (i.e. aqueous humour), because it resembles egg in whiteness, and therefore they have so named it.

Fifth is the tunic which they call *yanapia*, to be translated *khaloleni* (vine, uva), because it resembles that fruit of the vine, wherefore it is so named.

And the sixth membrane is named *kharnopia*, to be translated *eldschereni* (= *cornea*), which is why they have so named it. In itself it is exteriorly limpid and resplendent and smooth as if hard skinned, and this is the reason why when you open the eye you see the image.

But Gelianos (? Galenus) said these three tunics were one (or the first) *meninx*, and appealed in witness to the fact that when *karha* arises, which is a tumour (or ? blister, pimple, &c), and if it issues upwards into the *aponeurosis* (*mizl* or ? = *amnios*), it is quickly inflamed (lit. boiled) and at once opens and the *spin* (cicatrix) due to it is soft and there is not a white facula, and a remedy is quickly ascertained.

But if the tumour (?) is in the second *mizl* (*aponeurosis* or membrane), it inflames (*eft*) and opens late, and the *spin* (? cicatrix) which is due thereto (?) is thicker and white in colour, and a remedy is quickly ascertained.

But if the tumour penetrates the third *mizl* (? membrane), it is late to inflame and the *spin* (? cicatrix), which comes in it, is denser and firm and the colour, a white facula (? *dschah*), and no remedy whatever is known.

And if the tumour is large, so that it bursts itself, or the matter (*Khliv* = ὕλη, χυλός) be acrid (*sur*, or sharp), so that it opens, and the uvea appears exposed, if it appears small, they call it a *musca* (fly in the head).

If it appear large, they call it a *bepp*<sup>1</sup> in the head, and name it *karhay* (i.e. wound), and also they call it *bath* and *khakuart* (abscess).

And there is a seventh tunic called *multhahimay*, to be translated *Koshgrads* (= *conjunctiva*), and it is inside like a mantle (or shelter) to protect exteriorly, and it spreads out upon the membranes, wherefore they gave it this name, for it is a cartilage (*khrdjtam*). Wherefore they make a wide perforation in it and let pass the water, named tube inside like a *kamsh* (i.e. *gamysh* = reed-tube), and open the eyes by God's will.

#### 4. Concerning knowledge of the Muscles of the Eye and their function.

And be it known that the eye has four chief muscles : one, on the upper side (*dih*), which draws up the eye, towards the eyebrow, and one on the lower side, which draws the eye down, towards the nose and cheek, and one on the side of the source (or fountain), which pulls the eyes towards the eyebrow, and another on the side of the ear ; and there are four to the four sides, strong (? *bʾnen*), and if to any one of them humour penetrates, and they relax, the eye droops and drops and goggles, for it lengthens and is drawn back obliquely. But if one of them is affected by dryness, it is drawn back to the other in the same way, and that distorts the eyes, for whatever dries up the eyes drags them up and makes a squint, and this is the cause of squinting.

And there are two other muscles which they call *thevq* (wings). It is they that move the eye in a circular direction, up and down and from side to side, as a man desires.

And there are three other muscles destined to control the tube of the nerve fibre, at the end where the pupil is, so as to concentrate and keep the light in it. And if the mixture of these muscles be moistened and softened,

<sup>1</sup> *Bepp*, Persian for leopard.

or if they be lacerated by any outside shock, the light is poured out and dispersed all over the eyeball (lit. fruit), which they name *inthishar*, and which they translate *vathats*, i.e. outflow.

But if their composition dries up, and they contract, as for example a thong (or rope), falling into water, relaxes and is stretched; and if it falls into fire conversely contracts and shortens (lit. comes together), so now the muscles, when they are wet, become *inthishar*, and, when they dry up, draw together the tube of the sinew at its origin, and the pupil is compressed. And the pupil appears the eye of a needle. And this is what they name compression or contraction.

And there are three sinews (muscle or nerves) which control the upper lids of the eyes, and their function is to draw the two lids down. And one draws up the lid and opens the eye, but the lower lid has no sinews, and for that reason is not moved, and if it moves does so unnerved (lit. by non-muscle or non-sinew).

And these are the nine muscles in the eye we wrote of, three supplying the upper lid.

Now I describe the tube of the muscle (or sinew or nerve) and say whence it is generated, and how it goes to the eye, and its use or function. And we must remark that the head has three cavities: one on the hinder side in the occiput, one on the front side in the forehead, and one in the middle. And the hinder cavity contains the faculty of memory,<sup>1</sup> the middle one the understanding, which is the brain, and the front one the senses. And from the front cavity springs an united (or conjoint) nerve, which they name the first pair or conjoint, and at middle distance (or in the middle of its position) it has as it were a tube, and proceeds straight along the right side to the right eye, and leftwise to the left eye. And when they reach the inner part of the bone of the forehead, they confront each other and mingle and become one, and separate afresh at the same spot, and pass along the right side to the left eye, and leftwise to the right. And the reason why God so arranged is that in case one eye be blinded, the light collects in the other and is gathered in it adventitiously. And we have evidence of this in the fact that (he that) wishes to see things clearly, that is, things dim or afar, covers one eye for the light to collect in the other eye. And this Nature has taught us and made clear, and this is the tube of the nerve, along which visual faculty passes and reaches the eye.

Now I have to mention the visual soul, whence it arises and how the visual (faculty or object) comes to be through it,<sup>2</sup> when the stomach dissolves and exhausts (or presses) the food, and sends it on to the liver, and the liver receives and concocts it, until it is converted into blood; and in this concoction an exhalation rises as from all things in process of being cooked (or boiled), and this air, so far as it is in the liver, they name a spirit of Nature. Now what of it is limpid and pure (decent or normal or temperate) goes to the heart, and there is named vital spirit, and what is pure in it ascends by the ducts to the brain and enters the firm meninx, which is within the cranium, and there circulates along all the ducts and is further concocted and purified. And then it enters the second meninx, which is above the brain. In the same way it circulates these along all the ducts and is cooked and purified.

But nature which stood in need of this warm vapour knew well how to refine it, wherefore she made the road a long one and the passages narrow.

<sup>1</sup> Read *isholuthiun* for *ishol*.

<sup>2</sup> The transition is so abrupt that words may have dropped out.



And so it enters the front cavity of the head, and is there named the perceptive spirit, and when it is there sufficiently refined it enters first the conjoint nerve (or muscle), which contains it in its midst like a tube, and so it passes to the eyes, where it is named the visual spirit and accomplishes vision, through the moisture of the crystalline, and through the mediation of the tunics. So ends the description of the visual faculty by the will of God.

5. And you must know that the benevolent God set surely the faculty of vision in the middle of seven tunics, and made them a protection that no ill may reach it; by way of convenience also in order that the brain's moisture may do it no harm.

And as for the water of the eyes, he provided it that the heart's warmth and wind might not do harm to the eyes. And on the outside of the eyes God has provided two sets of hair, one on the lower lids and one on the upper lids.<sup>1</sup> The one he made for the sight and the other to carry away moisture from the eyes; for if there were not eyelashes, the water of the eyes would continually be leaking out. For see you not that when the lashes are kept away from the eyes, tears come regularly. If there were not upper lashes a man could not see anything from afar. The eyelashes enable him to see what is near, and the upper lids what is afar. And the latter it is that keep off the sun sufficiently for it to do no harm to the eyes. And a man whose eyelids are removed is like a channel into which the water enters, while there lack trees and grass along the banks; the channel is ruined by the soil filling it up. For the trees and grass along the banks kept it from being damaged. So with a man's eyes; when the hair is cut away from the lids he is liable to many maladies of the eye. God made man's eyes of light, and the sun takes light from light. When a child is separated from its mother and in that hour the moon is in star chamber of Zohal (Saturn), the child becomes *atchika* (blind or ophthalmic), for when the moon is in a foul star chamber, the seed of disease enters the eye.

#### 6. On the formation of the Ears.

God fashioned the ears for hearing, and the audition of man was arranged by him within the brain. And he appointed two ducts leading from the brain outwards to the ears. And God made the ears like a strain of music (or like a goblet) *speurô* (? spiral),<sup>2</sup> which when you strike it, gives a sound like a flute; and what is heard, it transmits to the brain which takes it in, and makes of it what is convenient.

And many men are deaf from their mothers' wombs, and that is owing to the fact that these two channels are blocked up. But those who being grown up go deaf, the cause is this: that from a superfluity of bilious matters a vapour ascends to the brain, and from the brain issues into the ear to the two channels and fills them up, and stops the hearing. For the passage by which we hear is then blocked. And often enough the cause resides in the phlegm (= *pituuta*), for an excess of this affects these two channels, and the ears, and stops them up, and denies you hearing. Scabies (*ψώρα*), however, does not create phlegm. But of black bile and of red bile and of blood a superfluity creates severe scabies, and they interfere with and prevent hearing.

God made the ear like a cellar (?) and built its entrance with a twist, so

<sup>1</sup> The word *Irander* 'upper lids' usually means 'eyebrows', but to so render the passage would make nonsense of it.

<sup>2</sup> The Vienna MSS. read *spetrô*, which recalls *spectrum*, but that gives no good sense in the context.

that foul air might not enter, nor an injurious sound easily enter the ear, and reach the brain and do harm. And (God) put in a naturally bitter liquid, and did so to check any harmful insect that might like to enter the ear, for it encounters the bitter liquid and is prevented from entering ; for because of its smell and taste they do not venture within, but flee and go back.

And God made more precious than the whole person the eye and ear ; but some physicians have said that the ear is more excellent than the eye, because, when it is dark and night-time, the eye cannot see anything, whereas the ear, even if it be night or day, hears everything, and, what is more, hears better by night than by day. And some physicians have rated the eyes higher than the ears for the reason that, if you do not hear a thing with your ears, you cannot tell another about it ; whereas the eye sees everything, and describes it to another person. And by way of example they adduce the thunder and lightning, but the eye sees the lightning and only afterwards the ear hears the thunder.

But God made the ear because of the brain, so that whatever is heard, is sent on to the brain, as the gentleman's doorkeeper does, who does not allow everyone, especially the unsuitable, to enter his master's chamber (*or* court), until he receives an order to do so from him, and then lets him enter. Just so the ear, which does not allow the unsuitable to come in.

#### 7. *Concerning the formation of the Nostril.*

God formed the nostrils in order to perceive all good or bad odours, and to expel and disperse all the brain's superfluities. And he fashioned the nose like a conduit to protect the brain. It gathers and keeps therefrom any superfluities. All this issues out by the nostrils.

And from the nostril a passage was devised by God to the windpipe, which when the mouth is shut lets the breath issue forth ; for were it not so, the mouth would have to remain open, and there would be a great risk of creeping things entering the mouth and doing harm, so that many would die of it.

And God made the human mouth like a box of which the padlock (*kuplag*) is a rampart gate.<sup>1</sup> And the nose was created downwards, firm and solid out of cartilage and free from the food that is being chewed, so that when the mouth is full, the breath can issue forth through it. And the fumes of bilious matters issue forth by the nostrils, and the breathing is not hampered nor the man strangled by them. And these fumes and superfluities in this way cannot enter the brain and harm it. For there is then an ample passage kept open, and, as long as it is open, this injury cannot befall a man. And the discharge of the nostril was made salt in flavour so that foul irritants (? *havaj*)<sup>2</sup> may not enter, and the brain remain uninjured. And if a thousand times the nostrils were open still creeping things would not enter, for its liquid is salt, and its presiding star is Lucifer. But God made the countenance (*eres*) of man fiery and temperate, and lo, it is clear that winter does not freeze it with cold nor summer torment it with heat, nor is it burned up by the sun, by the command of God.

#### 8. *Concerning the formation of the Mouth.*

God fashioned the mouth for eating, and made its liquid sweet, in order to receive the savour of all things ; and he fashioned the tongue in it in order by its continual movement to keep the mouth moist, and we receive the flavour on the roof of the mouth (i. e. through the palate) with the tip of the tongue ; for have you not remarked that when the tongue is cut off, the

<sup>1</sup> Probably the reference is to a battlement projecting above the main portal of a fortress and perforated beneath with apertures.

<sup>2</sup> The Vienna MSS. read *haut*, Arabic for *air*.

savour of things is lost and no longer perceived ? And the liquid which is collected in the mouth is generated in the liver ; and when it ascends from the liver, it supplies blood as far as the windpipe, and then by God's command it becomes white and turns into water. But if red bile is left in the liver, it causes the savour of the liver to be bitter ; and the water which is in the mouth becomes bitter. But if black bile is left in the liver, the savour turns sour, and the mouth becomes sour. But if phlegm is left in the liver, the savour of the mouth becomes salt ; but if there be only pure blood in the liver, and the liver be healthy, then the savour of the mouth is sweet and *mah thatil* (?) .

And God made in the mouth a passage to carry to the whole person flavours. But the presiding star of the mouth is Jupiter, while as that of the tongue was appointed Mercury, and that of the teeth is the same Mercury. For have you not remarked that when a man is in Mercury, he is soft and twistful in his speech, and cannot talk trenchantly, and a man who lacks teeth cannot fully enunciate his words ?

#### 9. Concerning the formation of the Heart.

God fashioned the heart as sovereign of the entire person, and made its nature hot and dry, placing the entire heat of the person therein, and constituting it the abode of warmth, so that the whole person is heated therefrom. The heart itself is perpetually in movement and has no rest, like the heavens which know no repose at all. So too the heart. And God made the heart like a tree which is broad at one end and narrow at the other. And the entire heart consists of two chambers.<sup>1</sup> There is one chamber on the right which contains living blood, and one on the left which contains air. But from the heart proceed four ducts, of which each divides into 32, so that in all there are 128 ducts, which the Arab calls its arteries. And together with these ducts the heart is in continual movement ; and they are evidence of life and death. For when skilled physicians lay their fingers on the duct which is called *madjas* (radial artery ?) they diagnose from every side the ailments connected with death or life, and apply the requisite drugs. And of these four ducts we mentioned, two are distributed to the upper parts of the body, and two to the lower, and they give force to the entire body, so that it is strengthened by them and keeps healthy, and as its presiding star was appointed the Sun.

#### 10. Concerning the formation of the Lungs.

God fashioned the lungs and constituted their nature cool and moist, and made it the chamber of phlegm which is *malus*. And God made the lung as the breath of life of the whole body, and placed it between the heart and stomach to be continually the refrigerator (?) of the heart, and allay (?) its ardour. And it also allays the heat of the liver, and prevents the heat and ardour of either of them from consuming the body. And God has constructed the lungs like an oven, that the air in it may constantly circulate within. If it were not so, a man could not at all keep his bowels (or middle) cool. And God made the lungs an air-chamber, to distribute the wind over the body, and wherever it is wanted it is made to go as required. And its presiding star he made to be the moon.

#### 11. Concerning the formation of the Liver.

God made the liver to preside like a good or evil star over the whole body, and made it the fountain (or source) of blood. And he made its nature hot and moist, and constituted it the furnace of the stomach, so that any

<sup>1</sup> Or, ? ' And the circle of the heart is to be set firm upon two chambers ' .

food which enters the stomach is cooked by the liver by its heat. And when the food is cooked, the liver draws its virtue (or strength) into itself, and in accordance with its nature converts it into blood, and distributes it over all the members, and feeds and strengthens the body.

At first it sends to the heart the simple (or clear) exhalations (or vapours) which issue from itself, and having reached the heart they are afresh distilled or rarefied and so rise to the brain. But the bitterness which like sulphur (?) escapes upwards, it sends to the gall to become yellow bile (*saфра*); and the other crude (uncooked or undigested) blood it contains as a moisture and heavy liquid, it gives to the lung, to become phlegm (*pituila*); and the blood, which possesses fat and is crude and mixed with water, it gives to the kidneys, to be cooked and become semen; but whatever is not accounted for goes to the *falabusht* or bladder, which discharges it without. But the rest of the burned blood is collected at the buttocks (or on the bottom) as sediment (*тpύξ*), and the *appuq* (?) gives it to the spleen to become bile.

And in this way the liver feeds all the members of the body.

But if it should happen that some indisposition affect the liver in the way of heat or cold, moisture or dryness, or if it be due to obstruction caused by constipation, the liver is oppressed and cannot get to their destinations its contributions to the various members, and these superfluities are left in the liver and cause it injury; and enfeeble not it alone, but all the members, and the body is consumed and peaked and is in danger.

But if the liver is oppressed by cold, and cannot warm the stomach, so as to cook (or digest) the food, the latter is left undigested (uncooked) and becomes bile, and thin water; and this water the liver cannot take up (? absorb, lit. bear weight of), but it disperses it through the body along the fibres and joints (or seams), and it causes paralysis and uselessness (*lakva*).

But if the food is left undissolved and passes down through the bowels, it causes *thugmay* (? dyspepsia) and *lopindsch* (? *gulundj* = tranchées), and looseness above and below.

But if the liver is overcome with heat, and the stomach be thrown into disorder and prevented from disposing properly of the food and from sending its contribution to its master, and if the passage for bile (or of the gall) be blocked, then the liver is unable to tolerate this yellow bile (*saфра*), but sends it abroad into the system (or person) and renders it *sralan* (? *delnu-thiun*, i. e. yellow.) And if the red bile penetrates to the lung, it stabs. And if to the spleen, it swells it up, and the colour turns yellow and the belly is enlarged and a morbid condition set up. And there are various other diseases akin to this, I mean in connexion with the blood, and the black bile, which, if it remain in the liver, causes divers maladies.

And there issue from the liver five huge ducts and spread over all the members, and its central duct is what they term the basilica (*pasilik*), and the lower one is the *catholice*, which they call *aqhal*; and the upper one what they call *kifal* (cephalic). But two other ducts issue from the liver, from which it passes to the artery.

And all the ducts issuing from the liver are incessantly in motion, and the divisions of all the ducts, which come from (or are in) the liver, are 232. And God made Jupiter to preside over the liver and other ducts. But the liver is one of the great members, which feeds and nourishes all the members by the will of God.

## 12. Concerning the formation of the Spleen.

God made the spleen like a stable, which collects in itself all the excrement, and sundry burnt blood which there is in the liver and ducts is all

gathered into it ; for the liver contributes to it all the burnt blood. And there is a duct from the liver direct to the spleen, along which all burnt blood is sent straight to the spleen ; and a duct from the spleen goes to the heart, which contributes cold to the heart, which counteracts the heart's heat lest it burn the person. And the duct from the spleen to the liver, when the spleen fails,—then the burnt blood therefrom issues to the liver. And the liver cannot sustain its weight, but disperses it to the members of the body, and renders a man *savtakot* (? melancholic) and carbunculous and pockmarked and *quthesh*, and otherwise diseased.<sup>1</sup>

And the cause of all this is burnt blood, which gathers in the spleen and damages the liver and excites these complaints. For the liver cannot carry the load and disperses it into the members. But if this burnt blood goes straight to the heart, it induces melancholy and epilepsy.<sup>2</sup> But melancholy is of several kinds, and one sometimes laughs, sometimes weeps, sometimes is calm, speechless, and insensible.

If this burnt blood collects and goes straight to the brain, it renders a man epileptic. And this ailment has three kinds like melancholy. One as it were besets a man and draws him from aloft downwards ; another impels him as it were to stand erect and then fall down, and he foams at the mouth, and makes foul noises, and dashes foot and hand and head on the ground, and many pass urine. Another kind is that which drives a man to a spring or to water, and he will declare that good children beset him, and talk with him and beat him. And all this is caused by burned blood collecting in the spleen and overburdening it and swelling it up ; and next it causes *isthislayilahmi*,<sup>3</sup> which means a tumid condition of the human system and the face grows fat ; and if red bile is mixed therewith, it produces pleuritis (lit. malady of the ribs).

God made the spleen cool and dry, and made it the chamber of black bile, and the taste is sour. And Zohal (Saturn) is appointed its presiding star.

### 13. *Kidneys.*

God made the kidney the seat of desire, and it was made more delicate and subtle than other seeds, and it was set firm in the middle by a sinew (*or* fibre), and from the sinew enclosed firmly in a pelt which protects [and] covers this pellicle of the kidneys so that the heat of the heart may not consume it.

And a duct of blood issues from the heart and goes to the brain, and from the brain descends along two ducts behind the ears and passes under the muscles through the one full of blood and through the other full of breath (*or* air), to the kidneys. And it descends and is cooked (*or* digested) and the water (*or* liquid) is afterwards separated and what is left becomes semen, and of it the child is engendered in the woman's womb by the command of God. The kidneys are so made that from the right and left hand one there is a passage for the water (*or* liquid). And they were made the abode of desire by God and of seed, and Lucifer appointed their presiding star.

### 14. *Concerning the formation of the Gall.*

God made the gall bladder the abode of bile which is red bile, because whatever of heat and dryness there would be in the person is all collected by

<sup>1</sup> Father Akinean renders his MSS. : ' And on the body warts are formed and eruptions are caused and pockmarks and erysipelas, and pigs (a kind of malady) and other forms of sickness.'

<sup>2</sup> *malas kath*. The first word elsewhere (Section 10) is interpreted phlegm. Akinean : pesanteur de tête or heaviness after drink. I believe it is μέλας, and that the words here used = μέλαινα σταγόν, *atra gutta*.

<sup>3</sup> ? Elephantiasis. Akinean : Hydropisii.

the liver and sent straight into the gall bladder ; and it has its entrance ; but it has no way of issuing out. And God made its fibre (sinew) cool and moist, and its pelt (*δέρμα, corium*) hot and dry, that the cold and moisture of the fibre and the heat and dryness of the pelt may take away the bile of the liver and correct the same. For were it not so, there would be heat of the bile and it would consume the kidneys.

And its presiding star is *Marekh* (Mars).

#### 15. *Concerning the Bladder.*

God made the bladder a vessel for the water of the entire person, so that whatever water is secreted from the stomach and liver may be collected in it.

But the bladder has two tunics. The interior tunic is the urinary receptacle (lit. water-pourer), and the outer tunic is for the semen, which descends from the kidneys along the outer tunic and proceeds to the right-hand testicle, where it is collected and then discharged by the urethra to fall into the woman's womb, where it engenders the child by divine command.

And stone is formed in the semen and is deposited in the bladder, and the urine and the stone pass out together. And there are some men who cannot pass their water ; for if the vessel of the urine becomes hot and dry, the urine comes out yellow and mixed with bile, and the passage burns and blocks the mouth of the bladder.

But if the penis (?) turns hot and humid, and then it is filled, but the man cannot retain or keep the urine, and it often issues forth, and if it should happen at any time that it forcibly hinders (micturition), then the man's body suffers relaxation, and the receptacle of urine is distorted ; and if for this reason (the urine) cannot any more enter (the urethra), and if no passage be found by which it can enter afresh, then [the urethra] often will burst and the man die.

God made the bladder cool and humid, and appointed the Moon to preside over it.

#### 16. *Concerning the formation of the Testicles.*

When the testicles were constituted by the command of God, man's strength was placed in them, and they were made the place of semen and of desire. And the desire of seed goes out from them and is spread over the body and the eyesight, which desires and impels a man to gratify his passion.

And a man's beard absorbs stuff from the eggs (i. e. testicles). You can make the experiment yourself. For a man entering the bath, before he washes lays them in sesame oil ; and when he quits the bath after washing, his beard becomes lustrous and soft and sleek.

And the eggs constitute the difference between man and woman ; for if they are cut, a man becomes beardless, like a woman. Nor can he any more beget a child, and they are one of man's most important members. The wise Galen declares there to be four important members in a man's body, viz. : 1, the brain ; 2, the heart ; 3, the liver ; 4, the eggs. Were they not one of the most important they would not be so allied with the heart, as you can see for yourself. If they are violently seized and insulted, a shivering comes into the heart and it faints, and unless they are quickly released, the man at once dies. And the presiding star is Lucifer or *Zôhray*.

#### 17. *Concerning the Stomach.*

God made the stomach of sinew and flesh, and around the mouth of the stomach runs copious sinew, but on the inside on the floor of it copious flesh ; for this reason that flesh is hot and sinew cold. And so the food is assembled in a hot place and there concocted ; for in a cool place things

cannot be cooked. And the sinew was for this reason set above, in order to draw the food and drink into it. And whether the food is at one time plentiful and at another scanty, makes no difference. For however much you drag the sinew it relaxes, and when you let it go it returns again to its position; whereas if you drag the flesh it at once is lacerated. And in the stomach are four virtues (*or* powers). The first they call *Djazip* (Arab. *pull*), because it is a dragging force, the second *masiq* (Arab. *retain*) which is retaining. The third they call *Hazim* (Arab. *digest*) or digestive, and the fourth *Tafiy* (Arab. *repel*) or expulsive, and sending out. But even if things are a thousand times light or small they require seven hours in order to be cooked (digested) and melted down. But if the stomach is hot and vigorous, and thoroughly dry or wet, food is rapidly digested before the fifth hour. But if the stomach be cold and wet, the digestion takes place otherwise. If the food be very light and defective, it is quickly digested and assimilated. And whatever one eats or drinks, the stomach assimilates it into itself and there it is digested; for on the right side is the liver and on the left the spleen. Above it again is the heart, and below it the gall; behind is the spine and in front the abdomen. And when the food and drink descend into the stomach then the inner mouth of the stomach shuts, so that the food and drink do not flow out until it is properly cooked and digested and its nutritive virtue appropriated, and sent on to the liver to make blood, and to be apportioned to all the members as suits them. And then it opens a passage to what is useless and conducts it out, and physicians call this the *pap* (i. e. *bab*), which is doorkeeper or pylorus.

#### 18. Concerning the Guts.

God made the guts in seven parts, for that is the statement of Bagarat (Hippocrates). But Galen declares for six guts. For the first one which is contiguous with the stomach is not reckoned by him among the guts, as it is by Bagarat; where it quits the stomach and divides off, it has another rôle than the guts, and is named the pylorus, because it discharges a different function. Moreover the six guts form groups of three, because three of them are thick and three slender.

The first thick one they call *ithnayashara*, which is twelve (*duodenum*), and another *lulin*, which is vocal. And another *musthalim*, which is foundation and sensation of the guts. But of the slender ones, the first is called *sayim*, which means dry gut, another *avar* or crooked, and another *talil* or minute. In all, three thick and three thin, apart from the pylorus which adheres to the stomach. But all food and drink taken by a man is collected in the stomach, which receives the nutritive elements as required, while the useless are presently dispatched without by the wind, for the latter descends to the lung.

#### Colóphon.

This book was written by Halathzaden, an unworthy sinner, dust and ashes. Remember Astuadsatur (i. e. Theodore) the Elder, our father, and Christ remember you.

### TRACT II

#### 19. Concerning the formation and devising of Bones and Sinews and Ducts (or Veins) and all Blood.

The all-wise God formed the joints of man of bones 248 in number, and articulated them together, and bound them fast with sinews, and cemented them into one body. And he set in them ducts for the vitalizing and irrigation (lit. inebriation) of the entire body.



Now in the head man has five bones, and in the entire *quateλ* (i.e. temple) is one bone, and the teeth consist of 32 bones. The whole number of bones in the head is 39. In the neck and vertebra<sup>1</sup> (or ? tibia) are two bones.

But in the hand, i.e. upper limb, in the shoulder are two. In the *dsil* or elbow is one bone. In the upper (?) arm one bone, in the forearm two bones. In the palm of the hand 35, which makes all the articulations of the bones of the hands 41, with a corresponding number for the hand on the other side.

In the back bone and vertebrae<sup>2</sup> there are 18. In the right hand ribs there are nine bones, in the left hand ribs eight.<sup>3</sup>

And in the feet (?), in the *Djar* there are two, in the member (*μελος*) one, in the knee two, in the shank (*srung*) two, in the vertebrae of the foot 35, which makes all the bones of the foot to number 42, with a corresponding number in the other one.

But a woman has 252 bones, four more than a man, and these four bones are in the generative space of the woman, and they interlock like fingers ; and when a child is about to be born, by the command of God they divide back from one another and the child issues forth, and as soon as it is separated from the mother, they close again and join by the command of God.

But God devised the sinews (or nerves) of man 248 in number, first the great sinews which are bonds (or yokes) 25, and then are divided, and become lesser (or thin) ones, 228 in number. And the sinews were made by God to hold fast the bones. But the ducts of man were made by God to replenish with moisture all the members of the body.

But God also set apart in the human brain 14 ducts, and attached every duct to a member, so that all the members are sustained and nourished by them, and are invigorated by one another and fortify the person.

And the ducts send and stimulate the person to movement, and the tongue to speech, and run also to eye and ear and other senses. For four ducts lead to the eyes and move them. Two communicate light to the eyes and two move them. But these two ducts which give light are void of blood and dynamical, so that the eyes are *datzmov* (?) sustained from the brain. When these two ducts are cool and wet, a man sees well from afar and ill from near ; but when they are hot and dry, one sees well from near and ill from far. And if they are violently harmed a man goes blind.

And two ducts run to the ear and are empty and bloodless. Their rôle is to guard the ear and transmit whatever it hears to the brain. And God created the ear a hard cavity and spiral, so that a loud sound cannot suddenly penetrate, nor water, nor insect get in and reach the brain and injure it. But if these two ducts are impeded by superfluities, then the ear is rendered deaf. And two empty ducts lead to the nose, to receive sweet smells and send them to the brain, and by night they keep ready.

And God made the nose a grotto (or fortress) to keep continually open by night and day, and to keep wet, in order to drain away all superfluities and preserve the brain clean and pure, so that the latter may remain untroubled by epilepsy and swoon, and from paralysis and from *lakua* (? helplessness) and lunacy (? melancholia), and from headache and all other diseases of the brain.

And there is a duct in the palate of the mouth which is sensitive to all savours, sweet or bitter, salt or saltless, sharp and acid, which pull and draw the brain to the controlling principle (?).

And another duct is in the tongue, which enables the tongue to talk.

<sup>1</sup> *lisern*, *κνήμη*, or *σφόνδυλος*, or vertebra.

<sup>2</sup> *lisern* above so rendered.

<sup>3</sup> One rib having been abstracted to constitute Eve.



And as the tongue is the hand of the jaws, which collects the food and gives it to the teeth for them to pulverize it ; in case anything escapes the teeth, the tongue collects it afresh and directs it to the teeth, like grain which is thrown with the hands between the millstones, the tongue being the hand of the jaws.

And two ducts lead to the hand, and each of these two ducts is divided into two. And one runs toward the right hand and one toward the left, and these regularly keep the hands in movement.

And two ducts go to the feet, which equally keep them in movement.

And one duct runs to the two testicles from the brain, to move them and hold them firm and enable them to fulfil its desire. It is the instrument of desire ; and if it is hindered from acting, they use drugs and infusions to re-establish and clean the duct, to enable it to function afresh.

And a woman's ducts are eight more in number than a man's, and she has four ducts which allow her to fulfil her female functions, and four in the breast whence milk issues, two to one teat and two to the other, which makes up the number of all the female's ducts to 248, by the will of the ineffable and incomprehensible God.

20. *Concerning the formation of the Seven Members, whereby man hath life* ; the first member is the brain, second heart, third liver, fourth lungs fifth reins, sixth gall bladder, seventh spleen, which makes up the seven organs in man that are not external, as are eyes, brows, nose, ear, tongue, hands, feet, testicles (eggs). For one of these may be cut off, or two or three of them, and the man survives ; whereas if a single one of these internal members on which his life depends fails, he dies irreparably.

And we are to know that perception, sensation, motion, wisdom and vigilance reside in the brain, whose nature is cool and moist. Life and light and strength and redness in the heart, whose nature is dry and hot. Joy and laughter and gladness in the liver, whose nature is hot and moist. Breath (*or spirit*) and voice and *yejul* (? *hival*) in the lung, whose nature is cool and moist. Desire and power to copulate and seed are of the reins, whose nature is hot and moist. Irritability and anger and love of power in the gall, whose nature is hot and dry. Shame and rancour and impatience and suspense in the spleen, whose nature is cool and dry. And as long as these seven members which occupy man's interior are of even tenor and free from superfluities, a man is healthy ; but if one of them chances to be injured, you may recover health with God's aid by means of wise physicians and drugs, for God has bestowed wisdom on experienced physicians so that they can make good by remedies the injury according to its nature.

But if the nature of the members gets astray and inverted, so that the brain turns dry and hot, or the heart cold and wet, or the liver cold and dry, or the lung hot and the gall cool, in such conditions of their natures, the possessor of them invariably falls sick,<sup>1</sup> and it is hard to heal him, nay, he can only die.

And God made in the windpipe a bit of flesh like a column, which is called *zankik* (? epiglottis or uvula), to protect the breath, so that no food or drink go astray and diverge from the passage to the stomach, and enter upon that by which the breath issues from the lungs. This going astray the epiglottis prevents. But if on a sudden food should pass along the passage by which the breath issues from the lungs and fall into the said pipe and obstruct the breath, then a man is oppressed and sick (lit. over-hot). In such a case the breath is constricted, and it is an effort to draw it ; for if it cannot find its way out, the man will die. For there is no interior passage by which

<sup>1</sup> *uchtavor* for *achtavor*.

it can escape, since the lung reposes (?) obliquely (?) on the stomach, and therefore has no passage from within.

And in respect of the lung physicians have said that it continually ventilates the lung ; for if the lung wing did not waft the air in from outside through the lung and so enable the heart to drive its heat without, then its heat would wax so great as to consume and burn up the system, and the man would die. On the other hand, except for the heat of the heart, which the lung receives from it, life could not stir in the man. And there are these two airs, of which the one issues out and the other enters in. The one which enters is cold and is called *pisar* (Pers. *bisear*, i.e. numerous) or *erat* or ample and copious ; but that which goes out is stifling hot and is called *khupat*, i.e. wanton or proud and potent (?).

And skilled physicians diagnose death or life by this criterion : when they lay their fingers on the duct and understand.

And they call the liver *assamelptan* (?), that is the purveyor of the body and feeder. For when the meat and drink are collected in the stomach and digested, the nutritive and useful elements are passed on by it to the liver which receives them and converts them into blood and sends it streaming to all the members, and so nourishes and sustains the strength of the person.

Thin and clear blood is given to the heart, but the sour (*or hard or rough*) element of it to the gall, while such as is coarse (*or thick*) and watery goes to the lung, and what has a moderate amount of fat in it to the reins, and the dregs of the blood goes to the spleen. But such part as has little moisture and red (*or yellow*) bile goes to the bowels. For ill-digested and unwholesome matters descend into the gut from the stomach, for the bile to rarefy them. They are discharged for convenience, and any red bile or food becomes a superfluity in the liver, and descends readily into the guts.

And as long as the liver is warm and wet, it is vigorous of function and quick to digest and quick to pass on ; but if it be enfeebled, then the liver at once cannot digest and pass the food on. And this unconcocted blood remains in the gut and becomes scurf (*or scab*) and induces colic. And should pale bile increase in the liver and engender blood that like a fibre exists there and moves, the man will take too little nutriment and nature will not assimilate the food. And pale bile cannot give blood to the gall, because there is (only) enough of it in the liver, and it would cause harm and disease in the man.

But when there is too much of phlegm (*pituuta*) in the liver, so that it cannot send blood to the gall, as in the case of the pale bile we wrote of above, in this case it is badly liquefied and becomes water and sets up pains of *sokhay* (ill nutrition), so that the body swells. And when the black bile finds no passage to the spleen and the road is blocked, that gives rise to *Hillath* (Arab. languor), like pox, etcetera.

And of all the diseases which affect man, all the causes can be traced to the liver being feeble and unable to send on its superfluities (? secretions) to their places, and to distribute them to the members. For the health and life of the whole person is in the liver, by the care of God.

21. And now, brethren, our original was very imperfect and faulty, and we were barely able to bring to so much accuracy as this. And you that are aided by it, bear in mind the much-sinching servant, and may God have mercy on you.

### TRACT III

#### 22. *The Parts of the Body.*

The brain is a part of the body containing the bond (*or conjunction*) of life. Bone is the casing of the brain. Sinew is the (instrument)

of the body in movement. The duct (or vein) is the (instrument) of the blood. Blood is the nutriment of the body. The breathing is the (instrument) of spirit. Spirit is the (instrument) of prime movement. The belly is the instrument of primal fecundity (or enjoyment). The liver is the instrument for the replenishment of the veins with blood. The heart is the origin of living (or psychic) life or origin of the life of the soul. The soul is of one breath. The hands are instruments in giving and taking. The feet are instruments subservient to going one's way. The mouth is an instrument of voice and of taking food. The tongue is an instrument of speech and of taste. The sense organs are instruments of sensation. The eye is an instrument of seeing; the ear of hearing; the nose of smell.

Body is the instrument of touch. Bile is a refinement (or subtilizing) of blood. *Malas* (? = phlegm, *pituita*, mucus) is a refinement of bile. *Mamatz* (chyle) is a superfluity from first food. Seed is moisture with breath in transmutation of blood suitable unto life or a superfluity of the last food agreeable, and resembles a creative agency that begets him, or a nutritive soul (?). Creation and birth, or the first food of a living being in transmutation of body.<sup>1</sup>

And glory be to Christ, God our hope.

It is to be remarked that there are three sources (or beginnings, fundamentals), to wit, the cerebellum (or meninx) whence spring the sinews (or nerves) which run together to the neck, pass to the throat and divide towards the shoulders, hands, and rest of the body.

This nerve (or sinew) binds together and secures all the joints of the bones, and gives play and movement to the feet and hands and all the animal members. . . .

But the heart is the source (or principle or foundation) of the arteries; for it possesses two chambers on the right side to collect the blood, which it takes from the liver, and on the left side it contains air collected, which it takes from the lung. And on this side it has four ducts without blood, full of warmth, and it divides into 32 several ducts, which makes up 108 ducts, by means of which is distributed warmth and life (over) the entire body. And these ducts are called *madjas* (? μέλος).

And they reveal disease and health in man. But the liver is the source of the blood of the ducts that issue from it, five in number full of blood, and three of them of great size. And we call the uppermost duct *Kifal*, and the middle one *Basilica*, and the lower one *Akhal* (?). From these branches off a duct from the forearm. And all the ducts from the liver separately number 232, and by them blood is transmitted all over the person.

But be it remarked that the body is attended by these three, to wit, sinew (or nerve), artery, and blood duct. For strength descends from the head by means of sinews (or nerves), and distributes it to all the body and so affords sensation; and the blood feeds and strengthens, and an artery affords warmth and life to the entire body.

And the much sinning Halathidj the Elder ye shall remember, and may God remember us in the day of judgement.

#### TRACT IV

##### 23. Concerning the Human Organism.

Of the great Gregory of Nyssa.

An abridgment.

§ 3. Man is said to be of four constituents, for there are four causes of the genesis of all beings, fire and air, water and earth. And water is

<sup>1</sup> The last lines concerning seed are unintelligible.

a seminal nature, and generative after the semblance of woman. But fire is energizing after the semblance of nature ; for two of the elements are creative or active, fire and air, and two are passive, water and earth. For fire and air are male, while water and earth are female ; because the humidity of water without warmth of fire is barren, whereas warmth of fire and humidity of water, intermixed, are fruitful for generation.

The first synthesis (?) then of the four elements is fire ; because more subtle and ever moving and nimbler is the nature of fire, like the nature of desire in us which they call an irrational movement, i. e. passionate (*θυμικόν*) and concupiscent, whereby the living (being) is released, for without these it is impossible for the living being to be released and constituted.

The first movement then is desire on the part of the fire in us, by which one approaches a woman, and the instruments of the seed are two ducts which descend from the head to the reins and lead to the groin, the one duct is full of blood, the other is full of air ; and when the duct of blood reaches the groin, the blood is turned into seed, as in the breasts of women, where blood is turned into milk. And when one approaches a woman, the seed falls into the woman's womb, in the same way as seed of plants which falls into the earth. And in turn the seed of the woman, like milk in a vessel, is something warm, and the mingled seed becomes for her like the curds of milk, and in the union of seeds they are clotted with each other and form the foetus, and thereupon is fulfilled the word of Job which says : ' Like milk thou milkedst me and like cheese thou didst coagulate me.' And there is fulfilled the prophet's word which says : ' The two shall be made into one flesh ', for out of the seed of man and woman is made the child, out of the twain one flesh made substance, like a river divided into two streams and again united in one. Now by the coagulation of the seed in the woman's womb it is turned back into blood during six days, and on the sixth day there is fashioned the worm, as the prophet says, ' I am a worm and am not a man.' For the first man was only completed on the sixth day and moulded by the hands of God, but now it is from corruption and from passions that he is engendered. And on the fortieth day members are completed for him, and then he is created the spirit of God, as to whom he alone knows who created him ; as he said : ' The spirit shall go forth from me and all breaths I made ' (? from myself). But a female child is completed in 70 days and then receives the spirit. For a male child is assigned to the right side of the mother and the liver and gall are on the right side, and are hot and easily make the child to grow, as a flat country with vines quickly matures the fruit. And a female child is assigned to the left side of the mother, and there is the spleen, which is cold. For that reason the child's growth is long, like fruit on a mountain which ripens late.

But in the moulding of a child, according to the nature of the parents it comes into being ; according as they are diseased or healthy, so is constituted the alloy of flesh. Wherefore it is necessary for a man and woman to choose a time when they are untainted by sickness, for then their child will be healthy, like husbandmen who choose a time for sowing. For if the ground is dry, or again too muddy and wet, the seeds are damaged and give no healthy fruit. How much more he who sows rational seed for the engendering of children in rational soil ? Wherefore it is necessary to make good choice, that the child may be healthy and free from all complaints. But when the child begins to sprout in its mother's womb it receives food through the umbilicus and grows like a melon or a gourd which receives water through its stalk, etc.